

# PATENT SPECIFICATION

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## (54) METHOD OF ELECTRICALLY CONNECTING A CONDUCTING MEMBER TO A TERMINAL OF ELECTRIC APPARATUS BY MEANS OF ELECTRIC RESISTANCE WELDING

(71) We, SOCIETE DES AC-  
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 France, do hereby declare the invention, for  
 which we pray that a patent may be granted  
 to us, and the method by which it is to be  
 performed, to be particularly described in  
 and by the following statement:—

The invention concerns a method of  
 electrically connecting a conducting  
 member to a terminal of electric apparatus  
 by means of electric resistance welding.

At present, for electrically connecting  
 two electro-chemical generators such as  
 electric cells or accumulators together, or to  
 form a current output, a metal strip which is  
 assembled by electric welding is frequently  
 used. More often than not, this weld is  
 effected by laying one end of the strip  
 against a suitable metal part of the generator  
 and by making the two electrodes of the  
 welding apparatus bear on the end of the  
 strip.

However, the weld effected by this means  
 is not always of the best quality. More  
 particularly the quality varies as a function  
 of the relative thicknesses of the strip to be  
 welded and of the support receiving it. This  
 is due to the fact that part of the weld  
 current generated by the welding apparatus  
 flows through those sections of the strip  
 which are not used for the welding. It is  
 therefore desirable, in order to implement  
 this method, that the thickness of the metal  
 portion of the generator on which the strip is  
 welded be greater than the thickness of the  
 strip.

In order to avoid interference flow of the  
 weld current inside the strip to be welded,  
 the weld may be effected by applying one  
 welding electrode on the strip to be welded  
 and the other welding electrode on the

metal part of the generator near to the strip.  
 This method, however, has the disadvantage  
 of causing an alteration at the point on the  
 generator on which the other welding elec-  
 trode directly bears. Moreover, by this  
 method, only one weld point is formed be-  
 tween the strip and the portion on which it is  
 applied, and it has been observed that it is  
 difficult to subsequently form a second weld  
 point since the current flows almost com-  
 pletely through the first point. This is a great  
 disadvantage, for the use of high currents  
 between two generators makes it com-  
 pulsory to use connecting strips having a  
 great width.

According to the present invention, there  
 is provided a method of electrically con-  
 necting a conducting member to a terminal  
 of electric apparatus by means of electric  
 resistance welding, wherein the conducting  
 member consists at least in the region to be  
 welded of two metal strips in direct contact  
 with the terminal, and two welding elec-  
 trodes are applied to the two strips respec-  
 tively in such manner that the welding  
 current between the two electrodes passes  
 through one strip, the terminal and the other  
 strip in series.

Since, by this means, there are no signifi-  
 cant bypass paths for the welding current,  
 that current passes almost totally through  
 the welding surface and so satisfactory and  
 readily reproducible welds are obtained.

According to a particular embodiment,  
 the two strips are distinct.

According to another embodiment, and  
 with the aim of facilitating the relative  
 positioning of the two strips during the  
 welding operation, the two strips are  
 connected together by a common central  
 portion.

In order that the invention may be fully  
 understood, reference will now be made, by

way of example, to the accompanying drawings, in which:

Figure 1 is a plan view of two cylindrical generators electrically connected according to the invention by two parallel strips,

Figures 2, 3 and 4 are three vertical sections in the vicinity of a weld point showing the weld currents of two electric weld methods according to prior art, as mentioned in the preceding text, and a method according to the invention respectively,

Figure 5 shows the same view as Figure 1, but with a connection formed by two strips joined by a common central portion.

In Figure 1, the reference numerals 1 and 2 designate two cylindrical electrochemical generators, for example accumulators. In the example shown, the accumulators must be electrically connected together by connecting the metallic bottom 3 of the generator 1 with the metal cap 4 of the generator 2. The conducting member used is in the form of two metallic strips 5 and 6, formed for example by a nickel steel band, arranged substantially parallel to and at a slight distance from each other. They are welded by applying the two electrodes of the welding apparatus to the adjacent ends, that is to 7 and 8, and to 9 and 10.

The advantages resulting from the implementing of the method according to the invention appear clearly on referring to Figures 2, 3 and 4.

In these Figures, the reference numeral 18 designates the metal portion of the generator to which the conducting member is welded. In the case of Figures 2 and 3, this connector is in the form of a single strip 11, whereas in the case of Figure 4, which illustrates the implementing of the method of the invention, that portion of the conducting member to be welded comprises two parallel strips 12 and 13.

The arrows 14 and 15 symbolise the two electrodes of the welding apparatus. The current actually used for welding is shown by the arrow 16. The arrow 17 in Figure 2 designates the interference current which is generated in the strip 11 and which does not exist in the cases of Figures 3 and 4. However, in the case of Figure 3, the part 18 undergoes an alteration at the point on which the welding electrode 15 bears.

On the other hand the method of the invention enables good welds to be made even when the thickness of the part 18 is less than that of the conducting member. In a typical example the respective thicknesses of these elements may be 0.2 and 0.5 mm.

The invention includes the case where only that portion of the conducting member to be welded is in the form of two strips, the two strips being connected together by a common part at their centres, as shown in

Figure 5. In this Figure, those elements already shown in Figure 1 bear the same reference numerals as in that Figure. The conducting member 20 is in the form of two metal strips 21 and 22 arranged substantially parallel and connected together by a common central portion 23. The strips are welded by applying the two electrodes of the welding apparatus to two adjacent ends, namely, 7 and 8, and 9 and 10.

The advantages of the invention set forth previously subsist despite the existence of the portion 23 electrically connecting the parts 21 and 22 of the conducting member. Indeed, the interference current symbolised by the arrow 24 which could be set up, will be negligible due to the length of conductor it has to traverse, which results in a sufficiently high resistance between two adjacent ends 7 and 8, or 9 and 10. There is also an extra advantage that the use of the conducting member of Figure 5 holds over the use of that of Figure 1. The connector is positioned and held in place more easily during welding. Such connections are more particularly used for current outputs.

The method of the invention is applied equally well, whether the connections are substantially plane or curved. Thus the method of the invention can be applied to the interconnection of disc shaped accumulators by means of conducting members in the form of two parallel strips curved and welded at their ends on the accumulators. It should also be mentioned that the conducting members comprising two strips constitute a safety measure due to the fact that, if one strip becomes unwelded, there will remain a second strip to maintain electrical contact.

It should be observed that the method of the invention can easily be implemented for industrial purposes.

According to another aspect of the invention, there is provided an electrochemical generator provided with at least one conducting member such as described and assembled by the method of the invention.

#### WHAT WE CLAIM IS:—

1. A method of electrically connecting a conducting member to a terminal of electric apparatus by means of electric resistance welding, wherein the conducting member consists at least in the region to be welded of two metal strips in direct contact with the terminal, and two welding electrodes are lied to the two strips respectively in such manner that the welding current between the two electrodes passes through one strip, the terminal and the other strip in series.

2. A method according to claim 1, wherein the two strips are distinct.

3. A method according to claim 1, where-

in the two strips are connected together by a common central portion.

- 5 4. Electrochemical generator provided with at least one conducting member connected in accordance with the method according to any of the preceding claims.

5. A method of electrically connecting a conducting member to a terminal of electric apparatus by means of electric resistance

welding substantially as hereinbefore described with reference to Figures 1 and 4 or Figures 4 and 5 of the accompanying drawings. 10

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FIG.1

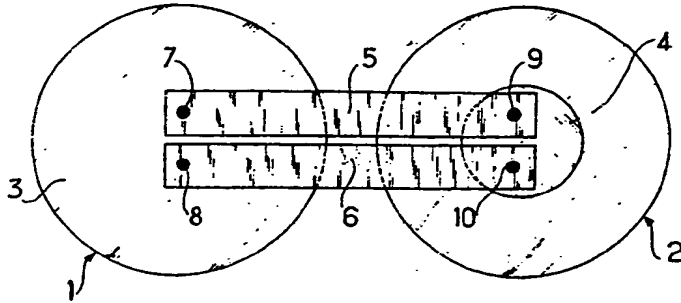


FIG.2

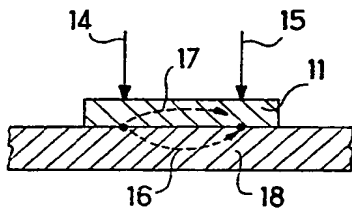


FIG.3

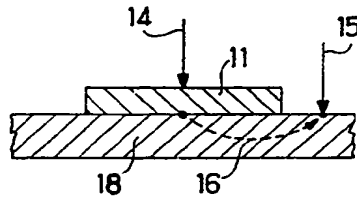


FIG.4

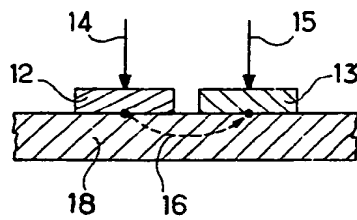


FIG. 5

